Visualization of the field line motions with extreme-high time resolution from three-dimensional global MHD simulations

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Comprehension on physics via numerical simulations is always restricted to its finite properties such as time steps and spatial grids. In order to investigate the physics as precisely as possible, required computing resources are super-computers, huge data storages, and high-performance workstations for a complex analysis/visualization. It is indispensable to prepare the reliable and seamless system which interconnects these resources. NICT currently develops such a system, called "Space Weather Cloud" service, which constitutes NEC SX-8R, Gfarm grid file system, and the Virtual_Aurora-installed workstation via JGN2plus network. Virtual_Aurora is the AVS-based software specialized in visualizing the 3D natures of the magnetosphere. Using this environment, we perform the global MHD simulations to investigate the magnetospheric dynamics, where the spatial grid is 88 (longitude) x 120 (latitude) x 120 (height) (the mesh size is approximately 0.25 Re near the Earth) and the time step is about 0.02 seconds. Within the simulation time (90 minutes), the data is outputted every 0.06 seconds (the total file size becomes 8TB). We develop the analyzing workflow which effectively and smoothly handles this vast amount of data set. As a practical example, the motion of magnetic field lines with the time resolution of 0.06 seconds is drawn by Virtual_Aurora to find the exact location of magnetic reconnection occurring, or to find the origin of the interplanetary magnetic field which will form the core field of flux ropes in the magnetotail.